

Learning Objective

Solve equations using the Subtraction and Addition Properties of Equality.

8.R.1

8.PS.6 Represent problem situations

Do Now:

FURNITURE Ms. Ruiz makes an initial down payment of \$150 when purchasing a sofa. She pays the remaining cost of the sofa over 12 months, at no additional charge. If her monthly payment is \$37.50, what was the original price of the sofa?

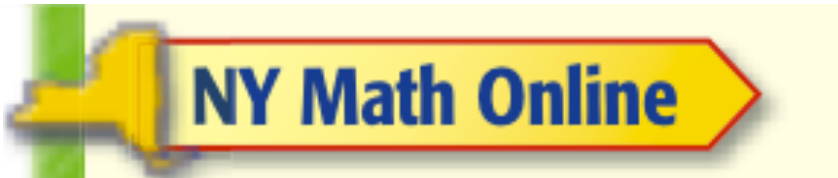
Mini Lesson

New Vocabulary

solve

solution

inverse operations

The logo features a yellow arrow pointing right, with the text "NY Math Online" in blue. To the left of the arrow is a green vertical bar and a yellow key icon.

NY Math Online

glencoe.com

- Extra Examples
- Personal Tutor
- Self-Check Quiz

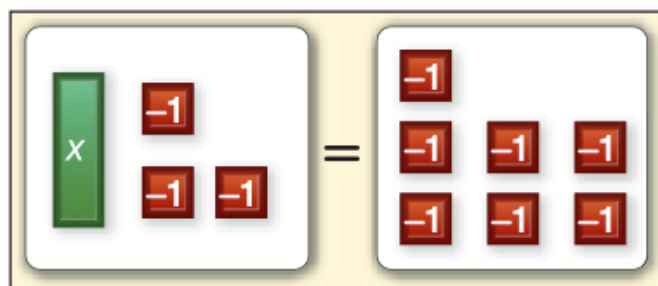


Solving Addition and Subtraction Equations

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When you **solve** an equation, you are finding the values of the variable that make the equation true. These values are called the **solutions** of the equation. You can use algebra tiles and an equation mat to solve $x + (-3) = -7$.

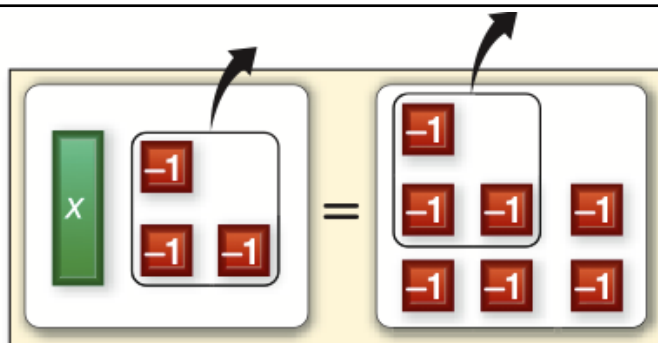


$$x + (-3) = -7$$



Model the equation.

Note: $x + (-3) = x - 3$



$$x + (-3) - (-3) = -7 - (-3)$$

Remove the same number of tiles from each side of the mat to get the x by itself on the left side.

another way
to look at it

$$x - 3 = -7$$

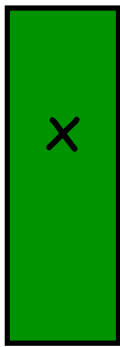
$$+ 3 = +3$$

$$x = -4$$

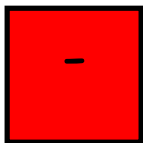
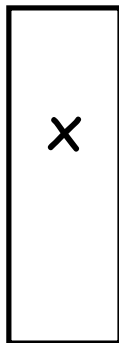
Get the variable
alone by doing the
opposite operation
to both sides of
the equation

The number of tiles remaining on the right side of the mat represents the value of x . So, -4 is the solution of the equation $x + (-3) = -7$.

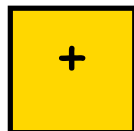
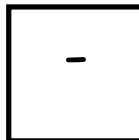
Algebra Tiles in your notebooks



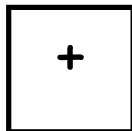
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Solve each equation **draw** algebra tiles.

1. $x + 1 = 4$ 

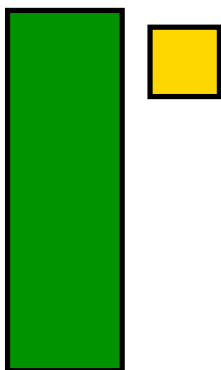
2. $x + 3 = 7$ 

3. $x + (-4) = -5$ 



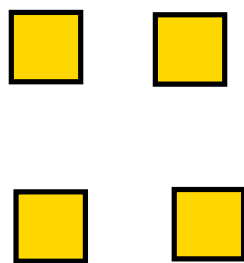
note: change
into a
subtraction
problem just
to have one
sign

$x + 1$

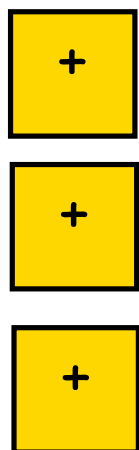
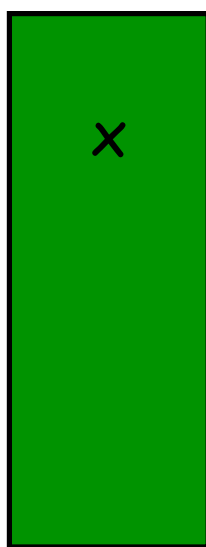


4

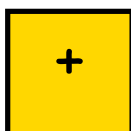
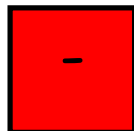
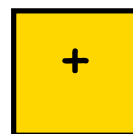
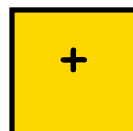
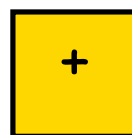
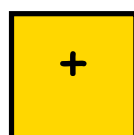
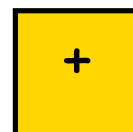
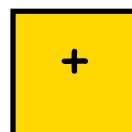
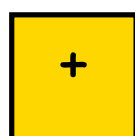
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$$X + 3 = 7$$

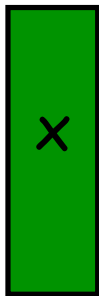


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$$x + (-4) = -5$$

or



4. Explain how you would find a value of x that makes $x + (-3) = -8$ true without using algebra tiles.

In the Mini Lab, you solved the equation $x + (-3) = -7$ by *removing*, or subtracting, the same number of positive counters from each side of the mat. This suggests the **Subtraction Property of Equality**, which can be used to solve addition equations like $x + (-3) = -7$ or $x + 4 = 6$.

Subtraction Property of Equality

Key Concept

Words If you subtract the same number from each side of an equation, the two sides remain equal.

Examples

Numbers

$$7 = 7$$

$$7 - 3 = 7 - 3$$

$$4 = 4$$

Algebra

$$x + 4 = 6$$

$$x + 4 - 4 = 6 - 4$$

$$x = 2$$

You can use this property to solve any addition equation. Remember to check your solution by substituting it back into the original equation.

EXAMPLE**Solve an Addition Equation**

1 Solve $x + 5 = 3$. Check your solution.

METHOD 1**Use the vertical method.**

$$x + 5 = 3$$

Write the equation.

$$\underline{-5 = -5}$$

Subtract 5 from each side.

$$x = -2$$

METHOD 2

Use the horizontal method.

$$x + 5 = 3$$

Write the equation.

$$x + 5 - 5 = 3 - 5$$

Subtract 5 from each side.

$$x = -2$$

The solution is -2 .

Check $x + 5 = 3$

$-2 + 5 \stackrel{?}{=} 3$

$3 = 3$

Write the original equation.

Replace x with -2 . Is this sentence true?

The sentence is true.



Solve each equation. Check your solution.

a. $a + 6 = 2$ b. $y + 3 = -8$ c. $5 = n + 4$

Addition and subtraction are called **inverse operations** because they “undo” each other. For this reason, you can use the **Addition Property of Equality** to solve subtraction equations like $x - 7 = -5$.

Addition Property of Equality

Key Concept

Words If you add the same number to each side of an equation, the two sides remain equal.

Examples

Numbers

$$7 = 7$$

$$7 + 3 = 7 + 3$$

$$10 = 10$$

Algebra

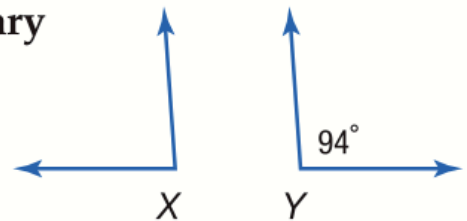
$$x - 5 = 6$$

$$x - 5 + 5 = 6 + 5$$

$$x = 11$$

EXAMPLE**Solve an Addition Equation****2**

MEASUREMENT Two angles are supplementary if the **sum** of their measures is 180° . The two angles shown are supplementary. Write and solve an equation to find the measure of angle X.



Words

The **sum** of the measures is **180°**.

Variable

Let x represent the **measure of angle X**.

Equation

$$x + 94 = 180$$

$$x + 94 = 180$$

Write the equation.

$$x + 94 - 94 = 180 - 94$$

Subtract 94 from each side.

$$x = 86$$

Simplify.

The measure of angle X is 86°.



- d. **READING** A novel is ranked 7th on a best-seller list. This is a change of -8 from its position last week. Write and solve an equation to determine the novel's ranking last week.

EXAMPLE**Solve a Subtraction Equation****3** Solve $-6 = y - 7$.**METHOD 1****Use the vertical method.**

$$-6 = y - 7$$

$$\underline{+7 = +7}$$

$$1 = y$$

Write the equation.

Add 7 to each side.

$$-6 + 7 = 1 \text{ and } -7 + 7 = 0$$

Study Tip**Position of the Variable**

You could also begin solving Example 3 by rewriting the equation so that the variable is on the left side of the equation.

$$-6 = y - 7$$

$$\downarrow$$

$$y - 7 = -6$$

METHOD 2**Use the horizontal method.**

$$-6 = y - 7$$

Write the equation.

$$-6 + 7 = y - 7 + 7$$

Add 7 to each side.

$$1 = y$$

$$-6 + 7 = 1 \text{ and } -7 + 7 = 0$$

The solution is 1.

Check the solution.



Solve each equation.

e. $x - 8 = -3$

f. $b - 4 = -10$

g. $7 = p - 12$

e. $x - 8 = -3$

$$\text{f. } b - 4 = -10$$

$$\text{g. } 7 = p - 12$$



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1-7 COPY ALL
PROBLEMS-SHOW
ALL WORK



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Solve each equation. Check your solution.

1. $a + 4 = 10$

2. $2 = z + 7$

3. $x + 9 = -3$

4. **RUGS** The length of a rectangular rug is 12 inches shorter than its width. the length is 30 inches, write and solve an equation to find the width.

Solve each equation. Check your solution.

5. $y - 2 = 5$

6. $n - 5 = -6$

7. $-8 = d - 11$

HOMEWORK

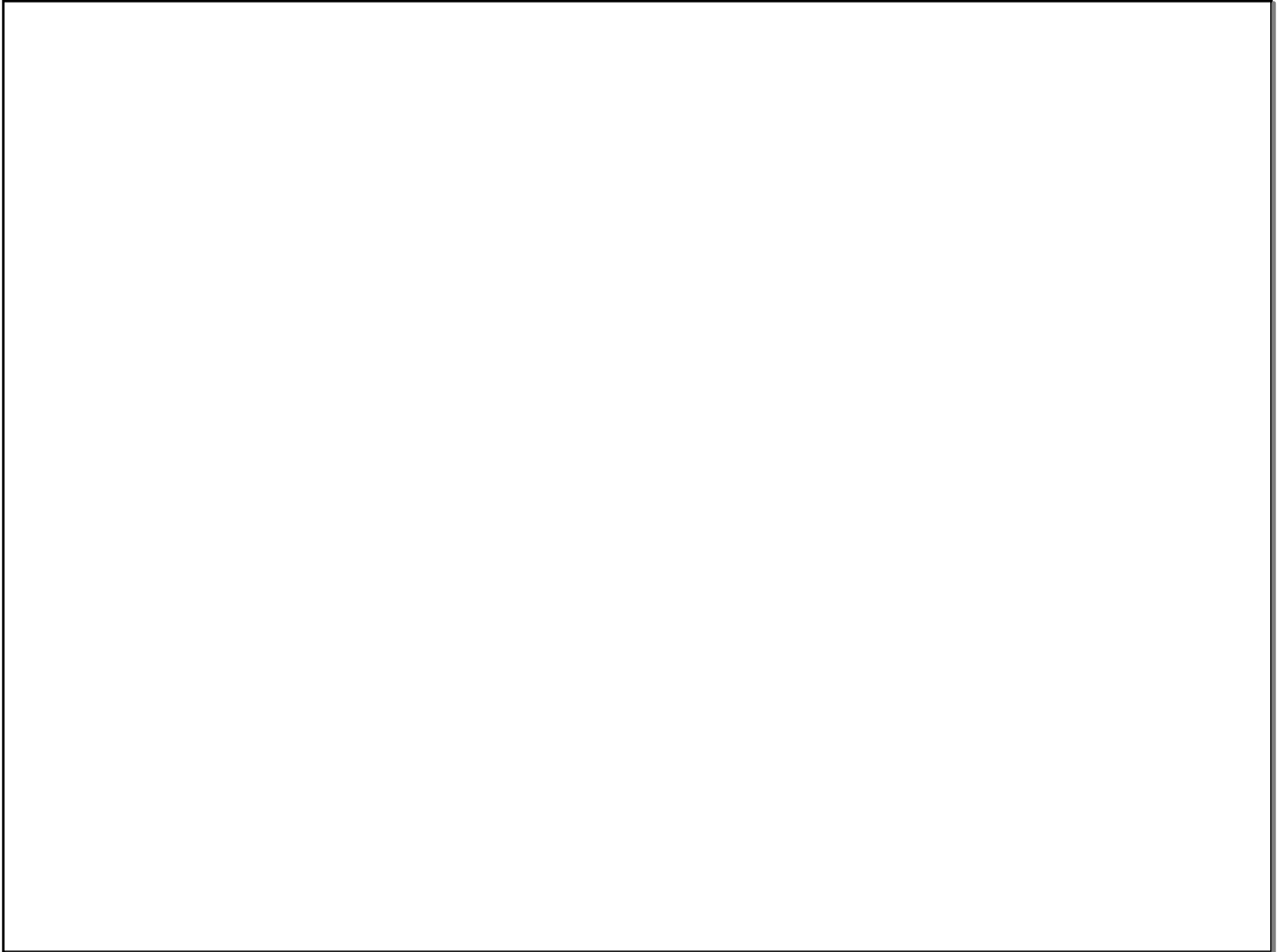
#7

Working Backward
Worksheet

HOMEWORK

▶ Practice and Problem Solving

#8
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Practice and Problem Solving

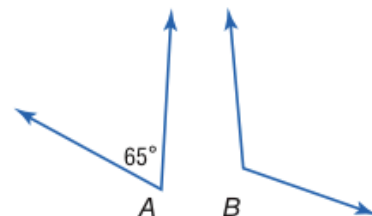
HOMEWORK HELP

For Exercises	See Examples
8–13	1
14–19	3
20–23	2

Solve each equation. Check your solution.

- | | | |
|-------------------|-------------------|-------------------|
| 8. $x + 5 = 18$ | 9. $n + 3 = 20$ | 10. $9 = p + 11$ |
| 11. $1 = a + 7$ | 12. $y + 12 = -3$ | 13. $w + 8 = -6$ |
| 14. $m - 15 = 3$ | 15. $b - 9 = -8$ | 16. $g - 2 = -13$ |
| 17. $-16 = t - 6$ | 18. $-4 = r - 20$ | 19. $k - 14 = -7$ |

20. **MEASUREMENT** Two angles are supplementary if the sum of their measures is 180° . The two angles shown are supplementary. Write and solve an equation to find the measure of angle B.



21. **BANKING** After you withdraw \$50 from your savings account, the balance is \$124. Write and solve an equation to find your starting balance.
22. **TEMPERATURE** On one day in Fairfield, Montana, the temperature dropped 84°F from noon to midnight. If the temperature at midnight was -21°F , write and solve an equation to determine the noon temperature that day.
23. **TREES** Before planting a tree, Manuel digs a hole with a depth 18 inches below ground level. Once planted, the top of the tree is 54 inches above ground. Write and solve an equation to find the height of the tree Manuel planted.